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AUTHOR Barker, Bruce O.; Bannon, James
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ABSTRACT

This paper describes the Hawaii Interactive Television System (HITS) program and provides an evaluation of the first year of broadcasts for the advanced placement (AP) calculus course. HITS allows two-way video-audio interaction among origination sites, but the configuration used by the Department of Education for its Teleschool program is the one-way video pattern with audio interaction through a telephone bridge. The purpose of the Teleschool is to deliver televised courses to schools that have low student enrollments in the targeted courses or are unable to secure a qualified teacher for the course. Eleven schools in both rural and urban locations participated in the first year AP calculus broadcasts. Most sites received class broadcasts live, but some schools showed videotapes of the class to enrolled students. Site coordinators and students were able to contact the Teleschool teacher through a toll-free number at his home during nonbroadcast hours. Results of a questionnaire survey of school principals, site coordinators, and students at each of the AP calculus Teleschool sites include: (1) students and site coordinators were particularly positive about the TV teacher's instructional ability; (2) school principals reported problems with transmission and with fitting the HITS class into the schedule; (3) students and site coordinators most frequently criticized the lack of teacher-student interaction; and (4) over 90 percent of the students said they preferred a traditional classroom. (KS)

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THE HAWAII TELESCHOOL: AN EVALUATION OF DISTANCE LEARNING FOR ADVANCED PLACEMENT CALCULUS INSTRUCTION IN "PARADISE"

Paper Presented at the 6th Annual Conference of the
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by

Bruce O. Barker
Associate Professor of Education
Brigham Young University - Hawaii Campus
Box 1954
Laie, Hawaii 96762

James Bannon
Director
Distance Learning Technology
Hawaii State Department of Education
3645 Waialae Avenue
Honolulu, Hawaii 96816

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THE HAWAII TELESCHOOL: AN EVALUATION OF DISTANCE LEARNING FOR ADVANCED PLACEMENT CALCULUS INSTRUCTION IN "PARADISE"

During the 1990-91 school year, the Hawaii State Department of Education (D.O.E.) piloted its first full year course to high school students over the Hawaii Interactive Television System (HITS). Known as the Hawaii Teleschool, AP Calculus classes were broadcast daily from Skybridge television studios at Maui Community College beginning on September 4, 1991 to 11 public high school sites on five different islands. Seventy-five students initially enrolled in the course. Sixty students completed the course which ended broadcasts on May 26, 1991. Of these, 35 took the AP Calculus exam; 12 students passed the AP exam.

The Hawaii Teleschool is now in its second full year of operation. A total of 69 students are enrolled in AP Calculus at 14 high schools across the islands of Kauai, Oahu, Maui, and Hawaii. The program is available to all public high schools in the state of Hawaii, however, preference is given to those schools without the resources to support or staff their own AP Calculus course. This paper briefly describes how the HITS program works and provides an evaluation of the first year of broadcasts for the AP Calculus course.

THE HAWAII INTERACTIVE TELEVISION SYSTEM

HITS is a four channel, closed circuit instructional television system intended to deliver live credit courses, meetings, and training to selected sites across the state. Since 1985 more than seven million dollars from the state legislature has gone toward establishment and operation of the system. HITS uses a combination of microwave, Instructional Television Fixed Services (ITFS), and cable technologies to transmit live, full-motion programming. Present origination sites exist at selected institutions belonging to the state public higher education system or facilities belonging to local governments located on the islands of Oahu, Maui, Kauai, Hawaii, and Lanai. The network serves as a teleconferencing resource for government, education, and some non-profit groups.

HITS is a complex and highly technical network. Though it allows two-way video-audio interaction among origination sites, the one-way video pattern with audio interaction through a telephone bridge is the configuration used by the D.O.E. Where appropriate, major commercial

cable operators on each island pick up the HITS signal and feed it to their subscribers on a community or educational access channel. This was the case with the AP Calculus class. To make audio interaction easier for students and more efficient, toward the end of the Spring semester, the D.O.E. installed two 800 telephone numbers enabling students to call into the classroom/studio to speak directly to their AP Calculus teacher.

Instructional delivery of AP Calculus was in three modes: (1) some sites received the class in a live, one-way video, two-way audio format; (2) others received it in a one-way video format via taped delay, but no live audio interaction; and (3) one site (Lanai) received it in a live, two-way video, two-way audio format.

A DESCRIPTION OF THE TELESCHOOL PROGRAM

Administration of AP Calculus over HITS has been under the direction of the D.O.E.'s Distance Learning and Technology division (DLT) and is a part of their Teleschool Program. The Teleschool Program is one of more than 10 different distance learning projects currently being managed by DLT staff. The purpose of Teleschool is to maximize educational opportunity for all learners through the use of technology. The traditional approach to education is for a teacher to be in a classroom full of students to provide face-to-face instruction. Students in schools that have small enrollments or which are located in remote locations are generally not able to take advanced placement or specialized courses because there are too few students who want to take these courses to justify hiring a teacher and/or the school is unable to recruit or retain qualified teachers for such courses. The DLT's Teleschool program operates by using the HITS network as the telecommunications medium to deliver televised courses to participating schools which have low student enrollments in the targeted courses or are unable to secure a qualified teacher for the course.

Secondary schools across the state were invited to participate, but preference was given to schools that were not currently offering calculus as part of their regular curriculum. This targeted schools that had such small classes it was deemed a hardship to offer calculus as well as those which were unable to recruit a qualified instructor to teach calculus.

Agreements Between DLT and Participating Schools

Responsibilities of schools wishing to receive the AP Calculus class included the following:

- Handle student registration in the course during the time block established by the DLT.
- Record grades established by the AP Calculus TV teacher.
- Provide credit on their own school transcripts and report cards, based on the grades assigned by the AP Calculus TV teacher.
- Provide a room where students enrolled in the course would be able to receive it either via cable television, ITFS signal, or some other means over the HITS network. It was necessary that the room be equipped with:
    - Telephone line. The school was responsible to pay the monthly phone charge; DLT agreed to pay for any long distance tolls associated with the course.
    - Connection to cable TV, ITFS signal, or microwave.
    - Television set
    - Videocassette recorder
    - DLT loaned video/speaker telephone
    - DLT loaned fax machine
    - DLT loaned text books
    - Other equipment that may be required (to be loaned by DLT)
- Provide an adult supervisor (site coordinator) who would be responsible to:
    - Attend a workshop on Teleschool procedures prior to the start of the class.
    - Check that equipment is operational prior to and during classes.
    - Contact the origination site if the system is not working.
    - Take daily student attendance for regular school records and Teleschool records.
    - Monitor students.
    - Reproduce materials.
    - Distribute handouts, collect homework, and proctor tests.
    - Work cooperatively with the Teleschool teacher.
    - Provide evaluation of procedures at the receive site as related to the Teleschool program.
    - Perform other tasks deemed necessary by DLT administration and Teleschool teacher.
- Provide supplies and instructional materials such as:
    - Paper and copy machine services to reproduce materials for every student. Masters were provided by the Teleschool teacher.
    - Videotapes to record the course.
    - Fax paper and other incidental expenses

For their part, DLT agreed to defray from the participating schools the salary of the AP Calculus Teleschool teacher and all transmission costs including telephone toll charges. Fax machines, video/speaker telephones, and course textbooks were made available to all participating sites.

Student Enrollments

Eleven schools agreed to participate in the first year broadcasts. These were Aiea, Castle, Kahuku, Kaimuki, and Radford High Schools and the UH-Manoa University Lab School all located on Oahu; Waimea and Kapaa High Schools on Kauai; Lahainaluna High School on Maui; Lanai High and Elementary School on Lanai; and Kohala High and Elementary School on the Big Island.

The participating schools varied in total 9-12 student population from a low of about 200 students to a high of about 1750. Four schools (all on Oahu) had 9-12 student populations near or above 1500. The remaining seven schools had student populations below 850. Five of the schools would best be described as urban in terms of their physical setting (Aiea, Radford, Castle, Kaimuki, and UH-Manoa Lab School); the remaining six as rural (Kahuku, Kohala, Lahainaluna, Waimea, Kapaa, and Lanai).

Method of Course Delivery

Since HITS uses a mix of technologies to transmit television signals, there was considerable variety in the manner by which participating schools received the class. See Table 1. Of greater significant, however, was the fact that two of the sites (Kahuku and Kohala) did not receive any live broadcast at all during the year. For differing reasons, each school showed videotapes of the class to enrolled students. Kahuku operates under a daily rotating schedule which made it impossible to watch the live broadcast. Kohala had no access to a cable carrier and was not in "line of site" to receive the class via ITFS. At Lahainaluna, students only watched the class live on Mondays. At Aiea, students watched the class live only three days per week. Broadcasts were received four days a week at Radford. Of the 11 sites, only 6 (55 percent) received class broadcast live, five days per week. These were Castle, Kaimuki, UH-Manoa Lab

TABLE 1

FORMAT BY WHICH COURSE WAS DELIVERED TO EACH OF THE PARTICIPATING SCHOOLS; AP CALCULUS TELESCHOOL, 1990-91.

School	Manner in which course was received
Aiea, Oahu	Broadcast live via cable on Monday, Tuesday, and Thursday. The class at Aiea only met three days per week. Students were responsible to obtain videotapes and watch on their own classes conducted on Wednesday and Friday.
Castle, Oahu	Daily broadcast live via cable
Kahuku, Oahu	Videotaped daily and shown to students during rotating schedule at school; no live broadcasts at all.
Kaimuki, Oahu	Daily broadcast live via cable
Radford, Oahu	Broadcast live via cable four days each week. Thursday classes videotaped; students watch on their own time.
UH-Manoa Lab School, Oahu	Daily broadcast live via cable.
Kapaa, Kauai	Daily broadcast live via cable.
Waimea, Kauai	Daily broadcast live via cable
Lahainaluna, Maui	Course was received during live broadcast via ITFS on Mondays. Tuesday through Thursday students watched video tapes because of rotating schedule at school. On Fridays students took video tape home because no math class was held at school.
Lanai, Lanai	Daily broadcast live via Skybridge to Maui Community College (MCC) Center about one block from Lanai High School. Transmission between MCC at Maui and the student at Lanai was in a two-way video and two-way audio format.
Kohala, Hawaii	Videotapes mailed weekly to the school. No live broadcasts received at the school.

School, Kapaa, Waimea, and Lanai. These six schools enrolled 31 of the 60 AP Calculus Teleschool students (51.6 percent). The remaining 29 students (48.3 percent) did not receive live broadcasts daily. And 8 students (13.3 percent; Kahuku and Kohala sites) received no live broadcasts at all.

To help facilitate communication between the Teleschool teacher and the schools after school hours, a toll free number was established which rang to the TV teacher's home. Furthermore, he acquired an answering machine to take messages when he was not available to answer the phone. Although this placed a considerable burden upon the Teleschool teacher to be accessible to 60 students and 11 site coordinators, it allowed students and site coordinators a means to contact the TV teacher (at times other than class broadcasts) at no personal expense to themselves or the school.

RESEARCH METHODS USED IN THIS STUDY

In April and May, 1991 site visits were made to Kohala Elementary and High School, Maui Community College, Lahainaluna High School, Aiea High School, Castle High School, and Kahuku High School. Contact with the UH-Manoa Lab School and with Kapaa, Waimea, Lanai, and Kaimuki schools was by telephone and facsimile machine.

Self administered questionnaires were designed for data collection from school principals, site coordinators, and students at each of the AP Calculus Teleschool sites. Questionnaires were distributed either during on-site visitation by the researcher or were faxed to the attention of the site coordinator, then returned via the U.S. Postal Service.

RESEARCH FINDINGS OBTAINED FROM QUESTIONNAIRES

Rate of return on the questionnaires was high. All 11 school principals returned completed questionnaires (100 percent return). Likewise, all 11 site coordinators returned completed questionnaires (100 percent return). And, 54 of 60 students returned questionnaires (90 percent return).

Student Background Information

Of the 54 students completing questionnaires, 50 were seniors (92.6 percent) and four (7.4

percent) were juniors. The average cumulative grade point average (GPA) for all students over the past three years was 3.52 on a 4.0 scale. Only three students reported cumulative GPA's lower than 3.0. Twelve reported GPA's of 3.9 or higher.

Ethnically, the majority of students (65 percent) were dominantly of Asian descent, and most of these were Japanese (45 percent). Most of the remaining students (26.6 percent) were of Caucasian origin. Other races included Chinese, Korean, Viet Namese, Laotian, Tongan, and Filipino.

General Opinions from Program Participants

Although principals were knowledgeable that a HITS class was being received at their school, actual visits by the principal to the HITS classroom to observe AP Calculus being taught were minimal. Actual classroom visits for the entire year ranged from a low of two to a high of 20. Next to 20 visits by one principal (UH-Manoa Lab School), the highest number of visitations was six (Kaimuki). The mean number of principal visits was 4.5.

Even though principals' visits to the HITS class were few, virtually all reported positive feelings about the class. Principals felt that there was little concern that HITS posed any threat to the teacher union in Hawaii or that classroom teachers felt their jobs might be threatened by the technology. Most principals also agreed that their school would benefit from other courses offered via HITS.

Reasons given by principals for participating in the AP Calculus HITS class was that either student enrollments were too low to justify hiring a teacher, or a qualified teacher was not available to teach at the AP level. Most schools (73 percent) indicated that they would not have been able to offer calculus as an elective if the class had not been provided via HITS.

Site coordinators were very positive about the quality of the HITS teacher and the AP Calculus class being delivered by distance learning. On a Likert type scale, site coordinators rated the HITS teacher extremely high in terms of being well prepared, easy to listen to and understand, and easy to contact if necessary. On the other hand, site coordinators reported that the HITS teacher was often unable to recognize their students' voices when they spoke over the system. Yet,

they felt he still seemed able to "reach out" via the television and make students feel comfortable and a part of the class. Coordinators were somewhat neutral in their ratings as to the HITS teacher's promptness in grading student tests and returning them for review. While they did not seem to feel that the HITS method of delivery made the course any more difficult for students than if it were taught in a traditional setting, coordinators' responses suggest that students would perform better in a traditional class setting if it were available. Site coordinators had no strong feeling about students cheating in the course. Nor did they indicate that scheduling the HITS class into the local school program was a problem. See Table 2.

Students enrolled in the course were less enthusiastic than either their school principal or their site coordinator regarding course quality. On the Likert type questions, students overall did not feel well prepared to take the AP Calculus exam. One-half of the students responded that it was not easy to contact the HITS teacher to ask questions during the class broadcast; two-thirds noted that homework assignments were not always promptly returned for review; half felt that classroom discipline was a problem; only one in three reported that the HITS teacher knew all the students by name in the class; and almost three-fourths felt that learning via HITS made the class more difficult than traditional classroom instruction. See Table 3.

Extent of Teacher-student Interaction

Site coordinators reported that, on an average, students in their classes spoke with the HITS teacher via telephone between two to three times per week. This included both during class broadcasts and after class using the toll free number provided. Student responses to this same item were considerably lower. They reported an average of two interactions per month during class broadcasts and about one call per month to the toll free number after class broadcasts. Students also indicated that the HITS teacher called on them during class broadcasts about once per week and that they usually received one set of faxed materials per week, and sent one fax weekly themselves. On the average, site coordinators said they spoke with the HITS teacher about twice per month.

When asked if they had a choice between taking AP Calculus via HITS or in a regular

TABLE 2

ATTITUDES OF SITE COORDINATORS CONCERNING QUALITY OF AP CALCULUS TELESCHOOL PROGRAM, 1990-91. REPORTED ON A LIKERT TYPE SCALE OF "1" TO "5" WHERE "1" REPRESENTS "STRONGLY DISAGREE" AND "5" REPRESENTS "STRONGLY AGREE." MEAN VALUES DISPLAYED, N=11.

Statement	Mean Rating: 1 = strongly disagree, 5 = strongly agree	N = responses to item
1. The AP HITS course appeared to be more difficult for students than the same course in a traditional setting	2.9	10
2. Students would do better in a traditional class setting.	3.7	10
3. I can easily contact the HITS teacher if I need to.	4.6	11
4. The HITS teacher can recognize the students' voices at my school and call them by name.	2.5	9
5. The HITS teacher is almost always well prepared.	4.7	10
6. The HITS teacher is easy to listen to and to understand.	4.6	9
7. The HITS teacher is able to "reach out" via the TV and make students feel comfortable and part of the class.	3.8	10
8. The HITS teacher promplty grades student tests, etc. and returns these so that students can review their work.	3.2	9
9. Scheduling a time for students in our school to participate on the HITS class has been difficult.	2.3	11
10. It is easy for students to cheat on tests and/or assignments.	2.4	11

TABLE 3

ATTITUDES OF STUDENTS CONCERNING QUALITY OF AP CALCULUS TELESCHOOL PROGRAM, 1990-91. REPORTED ON A LIKERT TYPE SCALE OF "1" TO "5" WHERE "1" REPRESENTS "STRONGLY DISAGREE" AND "5" REPRESENTS "STRONGLY AGREE." MEAN VALUES DISPLAYED, N=54.

Statement	Mean Rating: 1 = strongly disagree, 5 = strongly agree	N = responses to item
1. This HITS class has made me feel well prepared for the AP Calculus exam.	2.5	50
2. This HITS class has been more difficult than if it had been taught as a regular class at our school.	4.1	53
3. This HITS class has not interfered with my class schedule at the school.	4.0	53
4. I can easi contact the HITS teacher to ask questions during class.	2.5	53
5. This HITS class will help me get into college.	2.5	45
6. I have to work harder in my HITS class to get a good grade than I would if the class were taught like a regular course.	3.3	50
7. Homework assignments are returned promptly to me by my HITS teacher.	2.0	53
8. The HITS teacher knows all the students in my class by name.	3.4	50
9. Student discipline is not a serious problem in my HITS class.	2.7	52

classroom setting, students overwhelmingly favored regular instruction. Fifty-one students (94.5 percent) said they preferred the traditional classroom over televised instruction. Only three students (5.5 percent) preferred HITS. Students' rationale for favoring regular classroom instruction emphasized the lack of interaction they experienced in the televised format. Of 48 written comments, 40 related to the desire on the part of students to have greater interaction with a teacher in the classroom. Sample comments included: "I have an easier time paying attention to a teacher right in front of me; I don't get the help I need and tend to be distracted easily when I don't understand and can't tell the teacher that I don't understand; it's hard to learn from TV because it is very impersonal and you can't stop the teacher when he's going too fast or ask questions easily; the HITS program does not allow you to ask questions easily."

The HITS teacher visited each of the remote sites at least once during the school year. This was done in order to see site facilities and to meet students and site coordinators.

Teacher Assessment

The AP HITS Calculus teacher was rated very high as an effective teacher for the course by the site coordinators. Principals also rated the teacher highly. In fact, responses from principals, site coordinators, and students uniformly indicated the teacher was virtually always well prepared and definitely knowledgeable in the subject area. In open ended remarks, many students commented favorably about his keen sense of humor, creativity, and efforts to make the content understandable and applicable for them. Only a very few students (five) noted that the teacher occasionally made mistakes and that it was difficult to contact him over the system to seek clarification. A few other students (seven) also noted that turn-around time on exams often took longer that a week, leaving students wondering how well they had performed.

Observation of class broadcasts and video tapes by the researcher confirmed that the HITS teacher was an able communicator over the television medium. He generally started class with an explanation of the lesson purposes/objectives, a statement of what students were expected to learn, and an announcement of how he would proceed. His manner was generally conversational, yet professional. His lessons were well prepared and highly structured for televised instruction.

There seemed to be very little rambling or waste of instructional time. Writing on the mylar (white) board was usually neat and large enough for students to see, however, some students commented that his body was occasionally positioned between the camera and the board making it difficult -- sometimes impossible -- to see the board. He made good use of the Elmo visual presenter.

The major criticism noted from the field was that students were not always highly attentive and did not feel like they were as "accountable" as if they were in a traditional class. Teacher-student interaction was not high. Some students said they felt the pace was too fast and that they easily became lost, but this may partly have been their own fault for failing to interrupt the HITS instructor during broadcasts(via telephone) to ask that he slow down or provide more explanation. In live broadcasts, most students said they were seldom "called on" by the teacher to make comments or respond to questions. A number of sites noted that one school was "on line" by telephone much more frequently than the others. As a result, students at the other sites did not feel as though they were directly participating in the course, and hence could be somewhat "anonymous" while the class was being taught. Also, during researcher observation of videotaped classes at sites which did not receive "live" broadcasts, some students occasionally commented that they wished they could "call in" on the telephone to ask questions for clarification or greater understanding. When asked by the researcher if they used the toll free phone line after broadcast hours to ask questions, few students said they did. The most frequent explanation given was that they either did not think about it at the time or were too involved with other activities.

Role of the Site Coordinator

Of the 11 site coordinators, three (coordinators at Kahuku, Radford, and Castle) were able to count their HITS class as one class of their teaching load. Site coordinators at the other eight schools took on the HITS class as an added responsibility without load reduction or other compensation.

The role of the site coordinator was to take attendance, monitor students, distribute handouts, collect homework, proctor tests, operate equipment, and otherwise serve as the liaison between the HITS teacher and the students and the local site.

Positive Aspects of the Course

From the viewpoint of principals, site coordinators, and students the most positive aspect of the course was its availability. Most of the schools would not have offered AP Calculus if they had to provide instructional locally. The general consensus was that HITS made it possible for students to take an advanced placement course, even if only a few were qualified or interested, regardless of where their school was located. The fact that the program was offered to the schools at no direct cost to them in terms of securing the teacher or paying for HITS services was also seen as an appealing benefit by principals and site coordinators. A sampling of comments included: "course availability is a big PLUS!; there is a lot of hope and potential in the program; students were given greater course selection; I at least got to take a higher math class."

Students and site coordinators were particularly positive about the TV teacher's instructional ability. While several site coordinators commented that he was a very good or excellent teachers; most students highlighted his sense of humor, creativity, and friendly teaching style.

A few site coordinators as well as students noted that the videotaped format allowed students to watch the class at different times if necessary. Lessons could easily be recorded and reviewed at students' convenience. Others commented that the toll free number made it possible to call the HITS teacher at night or whenever they needed help.

Negative Aspects of the Course

For school principals, the major problems were related to transmission quality of the signal, fitting the HITS class into the local school schedule, and improving interaction between the HITS teacher and students. A sampling of negative comments from the site coordinators included: "hard to motivate students by long distance; students get lazy knowing no one is watching them; we are not receiving live programs -- delay makes program impersonal."

From students and site coordinators, the most frequent negative criticisms of the course focused around the lack of teacher-student interaction. Of the 11 sites, 6 received live broadcasts on a daily basis; the others either viewed some (but not all) classes live or watched videotapes of

tape-delayed classes. Students who watched in a video taped format did not have ready access to the HITS teacher. Relative to the lack of teacher-student interaction, criticisms from student written comments included: "we did not have the class live, therefore it was hard to follow; not enough student-teacher relationship; not enough communication in class; hard to ask questions; no way to ask questions without a lengthy hookup; not enough prompt feedback from teacher; I tended to slack off in class because my teacher wasn't there."

Some criticisms from students and site coordinators were also directed at technical difficulties associated with course delivery. A few comments included: "the method of communication is inadequate; problems with audio link between student and teacher during the show; the phone bridge sound problems were never resolved; many times we had to call the studio in Maui to tell them to turn up the sound so [the teacher] could hear our students; camera doesn't always show the blackboard when we need to see it; communication doesn't always work; reception is sometimes poor."

Suggestions for Improvement of Program

According to the 11 school principals, other courses besides AP Calculus which should be offered via HITS in the future are (listed in priority order): foreign languages (listed five times), physics (listed three times), English (listed two times), science (listed two times). Social studies, art history, trigonometry, European history, and geography were each listed by at least one school principal as important courses to teach via HITS in the future.

Site coordinators suggested that student homework be collected more often, the site coordinator be given some authority in assigning student grades, the class be taught only four days a week so that one day could be used for "catch up," etc.

Forty-nine of the 54 students responding to the questionnaire offered suggestions for improving the course. Seven students (14 percent of respondents) expressed disappointment with the course and suggested it be canceled. Most students were more positive, offering suggestions for improvements rather than discontinuation of the program. Several students requested that the grading system be more rigorous. Comments from some students inferred that they were not as

conscientious in completing home work because it did not always count towards a grade. Students also suggested that work submitted to the teacher be corrected and returned to them more promptly. Other suggestions were that the audio system be improved, that more interaction occur with the HITS teacher, that all sites participate in a live broadcast format, etc.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions: Based on an analysis of questionnaire results, interviews with participants, and observations made during site visits, the following conclusions were drawn:

1. AP Calculus, as taught via HITS, is very cost effective for local schools. Local schools have not been responsible to pay the salary of the TV teacher or pay transmission costs to bring the program into their school.

2. AP Calculus was offered to schools which otherwise would not have taught the course. This benefitted students in small, remote schools where low student enrollments could not justify hiring a teacher for only one or two interested students. Also, students in large, urban schools also benefitted where a qualified teacher was not available to teach calculus at the Advanced Placement level. Furthermore, 60 students completed the course for credit, 35 took the AP Calculus exam and 12 students (pass rate of 34.2 percent) passed it. Although only one in three students who took the exam passed it, the others completed a year of course work in an academic subject that would otherwise have been unavailable to them.

3. The AP Calculus HITS teacher proved to be highly committed to the program and was overall well respected by site coordinators and most students. Nevertheless, many students were critical of the slow "turn-around" time on grading of tests. They also requested higher levels of teacher-student interaction over the system.

4. Several technical difficulties remain to be worked out. The ITFS reception at Lahainaluna High School was of poor quality. With the exception of Lanai, all other sites received the signal via cable either in a live or tape delayed mode. Cable reception was generally of good quality, although there were occasional complaints of screen "fuzziness" from schools receiving the broadcast via cable signal. The major technical complaints, however, have to do with the audio-talk back component of the system. Students calling from the field during class broadcasts to ask questions expressed frustration on not being able to get into the classroom studio promptly, and once connected often experienced a poor quality audio hook-up.

5. Scheduling of the class was a serious problem that is not easily resolved. Of the 11 sites, two received no live broadcasts (Kahuku and Kohala); three others received live broadcasts only part of the time (Lahainaluna, Aiea, Radford); six received broadcasts daily. Local schools establish their own starting times and their own bell schedules. Some operate on rotating schedules, other do not.

6. Student interest and attention at receive site locations was found to be sporadic. Not all site coordinators consistently remain in the classroom with students either during live broadcasts or taped classes. While some students may be highly attentive, others often talk among themselves, do other homework, or only passively watch the TV.

7. The class promoted high levels of peer interaction and peer tutoring. When students felt "lost" or needed help in the course, they reported that 52 percent of the time they went to each other for help. They also reported seeking help from the site coordinator and the HITS teacher, but at much lower frequencies.

8. Quality of facilities at each of the receive site locations vary. Most have only a 19 inch TV screen which is too small for more than 4-5 students to easily see, especially when trying to follow complicated mathematical computations. In a couple of schools, the AP Calculus HITS students were in the same classroom with a regular class, but segregated to a side or corner where they could watch the TV. In such a setting, the speaker telephone picked up extraneous noise making audio talk back difficult. In some classes, the TV screen caught extensive reflections or glare from outside windows making it hard for students to watch with ease.

Recommendations: Based on findings resulting from this study, the following recommendations were set forth:

1. The program should definitely be continued, and expanded to benefit other schools. Since the bulk of expenses are paid by the D.O.E. the cost to local schools is minimal.

2. The level of teacher-student interaction in live broadcasts needs to be increased. TV is a passive medium and students who are watching TV for instructional purposes can easily equate this experience to watching TV for recreation. That is, if they get bored watching TV at home, they simply change channels. In a school setting such as the AP Calculus class, they can't change channels, but they can and do "tune out." In order to maintain student interest and keep their attention, the TV teacher must "force" interaction. Efforts should be made to involve all learners at each site in class activities. Calling students by name to participate in class discussions will personalize lessons as well as "put students on notice" that they are each responsible to participate as active learners. Directed questions to a specific student(s) can be an effective approach in gaining more student participation. The TV teacher might also maintain a log, by student name, of who is participating and who is not. This can be used as a record to help remind the teacher to call upon noncontributing members in the class or to more equitably distribute teacher-student interactions.

3. Attempting to coordinate bell and class schedules among all participating schools may be next to impossible, but it is strongly recommended. Since almost one-half of the schools (five of 11 sites) receiving AP Calculus viewed portions of their lessons via videotape, the challenge to the TV teacher to try and keep all of the classes progressing at the same pace became very difficult. It placed an unfair burden on him as well as on students. The DLT should work closely with school principals to see if this problem might be resolved, or at least minimized.

4. Consideration might be given to reducing broadcasts from five days per week to four. This would give schools the flexibility of one day per week to work around local schedules, provide opportunity for students to do make-up work, or to receive individual tutoring, etc. It would also give the TV teacher a rest from the demands of daily broadcast to perform grading tasks, planning, etc.

5. Turn-around time for grading of student submitted work needs to be improved. Prompt feedback to students on the performance of their written work is an important factor in keeping student morale high.

6. Students should be encouraged to make greater use of the toll free line after class when they have questions or need extra help. It appears that this service was under used by students this first year. Yet, the idea is a good one and with more encouragement may "catch on" for students in the future.

7. Formal contact should be made with HITS personnel to address some of the recurring technical difficulties. This is especially true of the audio-talk back aspect of the system. Students and site coordinators uniformly complain that this is of low quality.

8. Local sites should "free up" the site coordinator to be with HITS students entirely during the time that class broadcasts are in session. He/she should not have other responsibilities (eg. monitoring another class, grading papers, etc.) while the HITS class is being aired. The site coordinator needs to be with students in order to keep them on task and attentive, control discipline, and help answer questions when he/she is able. Supervising the HITS class should not be an added responsibility placed upon the teacher. It should count as one class of their load.

9. Ideally, the HITS classroom at local sites should be in a setting that does not interfere with or distract learning. If possible, HITS students should be separated from other classes. They should not be segregated to the back of a room to watch the TV while a regular class is simultaneously being conducted in the same room. Also, arrangement of the TV monitor and the speaker telephone should accentuate good acoustics and clear viewing. Common sense should prevail in not crowding too many students around a small TV screen, then expect them to maintain interest when they can't adequately see what the TV teacher is doing. Finally, the TV should not face an outside window. This results in excessive glare that strains the viewers' vision.

REMARKS

It is evident in Hawaii that students in both urban and rural areas may be denied higher level or advanced courses because there is insufficient enrollment to justify the cost of hiring a teacher or a qualified teacher may not be present. By electronically linking a number of students at several schools into one class, distance learning makes it possible for these students to receive higher level courses.

Distance learning takes many forms and can involve many different combinations of technologies. Because of the monies already expended by the state legislature and the attention given HITS, this system will undoubtedly remain the distance learning medium of choice for Hawaii.

Regardless of the sophistication of the technologies used or the complexity of the HITS system, the key to successful distance education is the expertise and enthusiasm of skilled teachers. Since distance education is fundamentally the interaction of students and a teacher in separate

locations, it becomes obvious that successful distance education depends on creative use of the medium and a high level of interaction between teacher and students. The teacher must consistently "reach out" and make students feel that they are a part of the class. He/she must skillfully involve all students, and do it via the TV camera. The challenge is not an easy one.

The completion of the first year of AP Calculus via HITS has identified several successful practices as well as some areas where improvements need to be made. As practice improves and as technical problems are corrected, this approach holds great promise as a means to bring curriculum equity to the state's public schools. It should be aggressively pursued.